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ABSTRACT

In the field of educational assessment, many changes are going on that are designed to make measurement or assessment meaningful to both teachers and learners. Conditions that support assessment development and research are identified. The need for developing assessments for teachers and learners is being supported by research on unintended effects of testing programs, changing theoretical underpinnings of assessment, and the independence of test development from educational practice. An example of assessment development for teachers and learners is the Mathematics Assessment Questionnaire (MAQ), a survey of thoughts and feelings in the mathematics classroom for grades 7 through 9. The questionnaire provides insight into the meanings that students construct from assessment. Technology can help the teacher construct meaning from the assessment, as the research of the author and colleagues into the use of the MAQ illustrates. Conditions that support assessment development and research in New York communities include: (1) new organizational arrangements to foster the integration of theory and practice; (2) studies that make explicit use of theories of teaching and learning; and (3) development of procedures to extend and adapt existing assessment development procedures. Eight tables summarize points in the discussion. (SLD)

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Assessment for Teachers and Learners

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Today there are many exciting changes going on in the field of educational assessment. I broadly characterize these changes as the effort to make measurement or assessment meaningful and useful for teachers and learners. That is, there is an effort to define and develop assessment FOR teachers and learners, rather than assessment that is ABOUT teachers and learners. These changes are taking place in a rapidly shifting context for educational assessment. This context includes the likelihood that there will be national standards of achievement promulgated for the public education system, and potentially a quasi-national or national testing system.

For educational psychologists, the definition of the meaning and use of assessments for teachers and learners has a particular importance. For example, in Table 1, the definition of meaning requires trying to understand the inferences that teachers and learners make from the process of assessment (preparation, participation, outcomes). By inferences, we mean what interpretations or narratives teachers and students construct from the assessment process--about themselves as teachers and about themselves as learners. By useful assessments, we mean what actions do students and teachers take based on assessments. For example, teachers may make particular instructional plans and students may ask questions of another student or a teacher.

Historically, the field of applied social science measurement, including educational assessment, has evolved into a profession that is based on general principles. These principles are modeled on a scientific paradigm that stresses generalizability across settings and thus functions more or less independently of the particularities of practice. The general principles also assume that measurement has an independence of local settings. However, assessment for teachers and learners, in the context of educational practice, is highly dependent on the local and particular, as indicated by the questions in Table 1.

My concern today is threefold:

1. to summarize the need for assessment FOR teachers and learners, specifically, the need for assessment in the context of practice;

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2. to briefly provide an example of assessment development for teachers and learners being conducted with the collaboration of teachers in New York schools;

3. to identify conditions that support assessment development and research for teachers and learners, in New York communities.

1. The need for assessment FOR teachers and learners

Why be concerned about assessment for teachers and learners?

At least three points indicate the need for concern about assessment in the context of practice, as identified in Table 2:

i. Research shows the effects of testing programs on practice, effects that are often unintended. And, research shows the beliefs about teaching and learning underlying most current testing practice do not match the prevalent views of educational psychologists.

Research on tests and testing systems has been sporadic.

[Early research was primarily concerned with teacher attitudes toward and knowledge about test scores (e.g., Goslin, 1967; Ward, 1980). With the use of large-scale testing systems for accountability and resource allocation, empirical research has examined the effects of such systems on teacher practice (Ellwein, Glass, & Smith, 1988; Haladyna, Nolen, & Haas, 1991; Salmon-Cox, 1981; Smith, 1991) and the model of teaching and learning underlying the test developer's views of education (Shepard, 1991). (Information on effects of tests used in evaluation research has also been described, cf. Campbell, 1977, on the corruption of test data).]

While assessment and measurement is used extensively in the work of educational psychologists, it has not been the focus of continuing research programs. For example, there is not an extensive body of research on the meaning and use of external assessments to students and teachers.

ii. Assessment programs are developing more complex performance assessments. There are efforts to integrate cognitive theories and assessment theory.

The changing views of teachers and learners provided by cognitive (and social) constructivist theory has already influenced assessment development (Tittle, 1990). One area in which the influence is felt in the development of complex

performance assessments and in related models of measurement (Mislevy, 1989). For example, there are assessment tasks that have open-ended formats and may have more than one answer or solution possible. There are group problem solving situations and writing tasks set in out-of-school situations. There are computer simulations and laboratory experiments, and there are portfolios of student work.

As an example, reading assessments may have several components and scoring based on models of the reading process, including mapping texts for structure and content. Students may be asked questions about their familiarity with the topic (prior knowledge), their knowledge about reading and reading strategies, and their interest in the reading tasks.

However, there is typically a time lag for the integration of theory into teacher development and practice. Therefore, teachers may be provided assessment information based on theoretical models with which many teachers have little familiarity.

An example is provided by the professional and curriculum standards of the National Council of Teachers of Mathematics. These standards have a cognitive constructivist view of teaching and learning mathematics, and were the basis for changes in the California Assessment Program. A case study of the California assessment in mathematics (Peterson, 1990) included classroom observations. One observer (Cohen, 1990), reported that teachers adopted some practices characteristic of a cognitive constructivist view of mathematics teaching and learning. However, adoption of practices did not mean an adoption of the underlying epistemology required for transforming classroom practice. Thus, in this example, there is not a good fit at present between theory, changes in assessment, and the context of practice. Is this unexpected? No, this situation is not unexpected, since assessment is being changed with the purpose of bringing change in teaching practice.

iii. There is an historical independence of assessment development practitioners from classroom practitioners.

Professional practice in test and assessment development has evolved to be functionally independent of practice in educational classrooms. This is not to say that teachers and students are not involved in test and assessment development. They are, but primarily to provide support for already-developed assessment plans or assessment procedures. Teachers provide judgements, sometimes write tasks, and students provide responses. Teachers are not typically an integral part of the assessment development

process. The Standards for Educational and Psychological Testing (1985) do not discuss roles for professional practitioners when developing tests and assessments.

In summary, the need for developing assessments FOR teachers and learners is supported by i) research on unintended effects of testing programs, ii) the changing psychological and educational theory underlying measurement, and iii) the independence of test development from educational practice. I propose that research is needed to develop an understanding of assessments in classroom settings and to support the intended meaning and effects of assessment processes and the resulting information.

I turn now to an example of assessment development for teachers and learners. I give this example because it provided an opportunity to explore an unusual area for assessment and to explore the meanings and use that students and teachers make of an assessment. Further, the example provides a way of understanding how the university may be able to work in collaboration, working toward collegueship, with teachers. The work described here has been supported by the Ford and Aaron Diamond Foundations, and the Graduate School of CUNY.

2. An example of assessment development for teachers and learners.

The assessment project

Let me provide one example of the meanings that students may construct from an assessment tool. The assessment tool is the Mathematics Assessment Questionnaire, and has its origins in research on women, minorities, and mathematics achievement and persistence in course taking.

The Mathematics Assessment Questionnaire. A survey of thoughts and feelings (MAQ) is designed for use in mathematics classrooms, grades 7-9 (Hecht & Tittle, 1990; Tittle & Hecht, 1990). As shown in Table 3, statements in the questionnaire ask the learner to reflect on learning and doing mathematical word problems to assess:

--selected student characteristics (self-regulatory skills and affective, motivational and attributional beliefs)

--in the context of classroom activities (During class, Working with others, and Homework)

Table 4 provides several examples of these statements.

To gain some understanding of the meanings that students may construct from an assessment tool, we tried-out one set of statements that asked students what they do before, during and after solving a non-routine mathematics problem. For example, students responded YES, NO, or MAYBE to statements such as:

I looked back at the problem to see if my answer made sense, and, I drew a picture to help me understand the problem.

In several classes we asked students to turn over the page and answer this question after they had worked a non-routine mathematics problem:

How did thinking about these questions help you think about how you do math problems?

Table 5 provides examples of some of the meanings that 7th and 8th grade students wrote down. For example, "Answering these questions helps me think about things that I don't do on math problems."

Asking students to write down their thoughts and asking students to talk aloud as they consider MAQ statements provide examples of beginning to understand the meanings that learners construct from assessment information.

A major concern of the project has been to work directly with New York City teachers throughout the development process. However, as we worked with teachers on thinking about how to make student responses readily accessible, we found that there was variability in the types of access to this information that teachers felt would be useful. As a result, the MAQ was adapted for computer administration and a computer-based teacher program was developed.

Using technology to facilitate teacher construction of meaning and use of assessments

Consider, for example, the teacher's task in constructing meaning from assessment results, for a class of from 15 to 40 students. For each of the students the teacher may consider: the student's instructional and personal history that may be relevant to her or his performance (responses) and to instructional planning; the classroom context in which instructional decisions are embedded in the learning and organizational environment of

the classroom and school; and an array of assessment results, such as that provided with the MAQ (Tittle, 1989).

In our current work we--Deborah Hecht, myself, Ralph Smallberg (Programmer), and graduate students-- have developed programs so that the survey can be computer-administered and the results compiled and examined on a teacher program disk (Tittle & Hecht, 1992). There have been many interactions and collaborations with New York City teachers in the development process. It has been particularly interesting to examine the manner in which teachers explore the unfamiliar assessment information provided by the MAQ, made available in an unfamiliar mode, using a computer program.

The assessment information is unfamiliar to teachers in the following way: there are 143 statements intended to elicit student beliefs about their self-regulatory thoughts and behaviors in each of the three activity settings (during class, with others, and homework). There are other statements in the areas of confidence, anxiety, interest, value, motivation, and attributions. These are areas complementary to the mathematics topics and skills typically assessed by teachers and by external testing.

Student responses are available to individual mathematics teachers in our project through a microcomputer-based program, also typically an unfamiliar way for them to view assessment information. Figure 1 provides the structure of the teacher program. A small set of teachers has volunteered to use the survey with a class and to meet with us individually to talk about their students' responses to the survey.

The procedures we have used with teachers are based on the think or talk-aloud procedures used in some cognitive research (Ericsson & Simon, 1984). In this procedure the teacher is asked to talk aloud as he or she explores the structure of the program, the structure of the assessment survey, the psychological constructs in the survey, and the responses of her or his individual students and class. (There are also help features and instructional strategies in the program that have not yet been systematically explored with teachers.)

We have used the transcriptions of these talk-aloud sessions to consider the meaning that teachers construct from assessment information. In speculating about the framework that might describe how teachers develop or change in their use of such an assessment tool and program, we have drawn on research from the field of evaluation (Hall & Loucks, 1977) and from current research on development and change of mathematics teachers (Schifter & Simon, in press; Franke, Fennema, Carpenter & Ansell, 1992).

The evaluation work focused on examining Levels of Use (LoU) of an educational innovation-- in terms of particular strategies. The work with mathematics teachers examined not only the teacher's adoption of new classroom techniques but also the change in "the epistemological perspectives that informed teachers' instructional decision making," that is, how instruction on a particular topic was thought about, planned for, and implemented (Schifter & Simon, in press).

We have developed a framework to describe teacher change using the MAQ assessment (Hecht & Tittle, 1992). This framework is given in Table 6, and proposes four levels of understanding, levels of the teacher's constructing meaning from the assessment information, using the teacher computer-based program (TMAQ):

Table 6. Teacher Levels of Understanding of Student Responses

1. Acquiring procedural skills and conceptual structures
 - i. acquiring facility with the computer program and the general structure of the assessment information
 - ii. understanding the psychological constructs that comprise the assessment information (definitions)
2. Contextualizing student responses in the psychological domain
 - i. accessing other, relevant information about the student
 - ii. interpreting the student or class response conditional upon this other information
3. Using the contextualized information to select or develop specific instructional strategies
4. Internalizing and transforming the assessment information about the psychological domain into other instructional settings and practices.

So far we have identified examples of the first three levels, in the five teacher transcripts we have examined. Level 4 is speculative.

Table 7 provides examples of the types of statements teachers make as they work with the MAQ to construct meaning

and consider possible instructional activities. It is also clear from the transcripts that we could identify other meanings that teachers construct from the assessment report, such as knowledge about the self as teacher (Tittle, 1991).

While the example of the Mathematics Assessment Questionnaire is particular, it provides an illustration of social science research in urban schools that can support assessment for teachers and learners, assessment that is linked more directly to classroom teaching and learning situations. The example also suggests that this area of assessment will necessarily link closely to research on teaching and learning in subject matter areas.

3. Conditions that support assessment development and research for teachers and learners in New York communities.

Based on our interactions with teachers and learners, we have suggestions for assessment development and research in urban communities. The conditions are briefly stated, given the time constraints today. The underlying premise is that assessment development and research need to be closely linked with classrooms--with teachers and learners, and with development and research on teaching and learning in the subject areas.

The conditions likely to support such assessment development are identified in Table 8:

1. New organizational arrangements that foster the integration of assessment research and educational practice.

Educational psychologists have actively been concerned with more meaningful, complex theories of teaching and learning, and with more complex models of assessment. Organizational arrangements are needed to support the engineering of these ideas into assessment research conducted in educational settings. The term engineering is used deliberately, to indicate adaptation of ideas or theories in the setting of practice. Research at the Center for Research on Evaluation (CRESST) at UCLA provides one example of such an organization, as perhaps does the middle school mathematics (QUASAR) project at the Learning Research and Development Center (LRDC) at Pittsburgh.

Engineering requires new approaches to applied research. As Bevan (1991) has argued in a science context, organizational arrangements, networks, or other structures need to establish what are, in essence, communities--here, in our example, communities of teachers and researchers. The Institute for Research on Teaching, established in the 1970s at Michigan State University by Shulman, and Shulman's

research project on teacher performance assessment come to mind as collaborative examples. For Bevan, what he calls the three Cs are paramount-- communication, collaboration, and collegueship.

In educational psychology, as an applied field, this translates into educational psychologists working with teachers and subject matter specialists, building communication, collaboration and collegueship. Because of the nature of our goals and interests, these arrangements must involve close work with teachers and learners in schools or other educational settings. These arrangements will take time and effort to establish, for the three Cs to occur: communication, collaboration, collegueship.

2. Research and development studies that make explicit use of theories (models) of teaching and learning to guide studies on the meaning and use of assessment information.

These studies should encompass a wide range of questions and methods. For example, studies can be designed to characterize the teacher's levels of understanding of assessments and student responses. Others can describe students' understandings of assessment tasks and students' explanations of their own results.

Still other examples of research can be descriptions and analyses of the assessment tasks, the procedures used for rating/scoring, the reporting of results, and other components of reporting systems, for any and all levels of aggregation. These analyses can examine the extent to which aspects of the assessment system -- tasks, administration procedures, scoring, reporting, aggregating, are congruent with an intended model of teaching and learning.

3. Development of a set of procedures to extend and adapt the existing set of assessment development procedures.

(The discussion here is based on work with Garlie Forehand (Tittle & Forehand, 1992).) We have described a constructivist perspective on assessment, starting from a particular point of view. This point of view recognizes that there are several sets of representations that need to be understood and examined throughout the process of assessment development. Here I will give examples for teachers and students, although other concerned participants include parents, principals, among others.

For example, assessment development procedures might well include examining the meaning teachers construct from an assessment task, to answer questions such as:

"What existing representations do teachers have about a learner's performance in problem solving? How are representations modified by particular assessment information? How do teachers explain a learner's assessment performance? What instructional actions do teachers suggest based on assessment?..."(Tittle & Forehand, 1992, p. 9).

Assessment development procedures might examine questions about students such as:

"What meaning do students assign specific messages about their performance? What features influence external versus internal attribution? What is the relation between the instructional function of feedback and the effect on self concept? How do students construct meaning from holistic analyses of complex performance? How much do students understand about the process of judging performance?..."(Tittle & Forehand, 1992, p. 11).

Current procedures examine student responses to develop indices of task characteristics and characterize a learner's development. New procedures are needed to describe types of task meaning and explanations of performance that are reported by representative groups of teachers and students, as well as those meanings intended by assessment developers. These procedures would provide links to established and proposed procedures for validation of complex, performance-based assessments (Linn, Baker, and Dunbar, 1991). Specific criteria for the rating schemes used to evaluate a performance task are described by Quellmalz (1991), and Valencia and Calfee (1991) have discussed concerns that need specification for portfolios used in assessment.

The criteria proposed by Linn and his colleagues, and others, will extend existing practice in validation research. They are concerned with consequences of assessment (corruption of the meaning of the assessments due to coaching and other unintended consequences), fairness, transfer and generalizability, among other criteria. The criteria arise from experiences with existing multiple choice tests and preliminary experiences with more complex performance tasks.

Summary

Our experiences on the Mathematics Assessment Project suggest that teachers are interested in collaborations, and that their collaborations are necessary conditions for assessment development in New York communities. It takes time and trust to establish the necessary conditions for assessment for teachers and learners.

Universities have much to offer in teacher collaborations. However, to collaborate in development and research on assessments that are for teachers and learners, we need to build relationships, communications, that establish the understanding that teachers, and students, are colleagues.

The promising developments in assessment for teaching and learning require renewed efforts to foster educationally-relevant meanings and uses of assessments. Some of the more complex performance assessments have scoring components and procedures based on models of cognitive processes and expert performance, as well as more global educational outcomes. To the already existing complexity of the classroom setting, we are adding assessment information based on theoretical models with which many teachers (and students) have little familiarity. Building and supporting collaborative assessment development and research networks for teachers and university groups will be critical for long-term change to assessments that are meaningful and useful for teachers and students.

I have drawn my examples of research primarily from educational classroom settings, viewing teachers as professionals. Similar examples could be developed for counselors, school psychologists, and subject matter supervisors (e.g., mathematics coordinators and supervisors). The discussion and many of the general principles I suggest here for assessment research in the context of classroom practice will generalize to other professionals using psychological assessments, to clinical psychologists and industrial organizational psychologists, as well, to foster understandings that will maximize the meaningfulness of measurement.

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TABLE 1

**Assessment for Teachers and Learners:
Assessment in the Context of Practice**

Assessments that are meaningful

What inferences do teachers and learners make based on an assessment?

For example, what interpretations and narratives do teachers construct about their own performance and about their students' performances?

For example, what interpretations do students construct about what they know and what is expected of them?

Assessments that are useful

What actions do teachers and students take based on assessments?

For example, what instructional plans and decisions do teachers make?

For example, what parts of assessment information do students remember and act on?

TABLE 2

**Reasons for concern about assessment
use by teachers and learners**

- 1. Research shows the effects of testing programs on practice, effects often unintended. And, research shows many tests are developed based on beliefs about teaching and learning that are not the beliefs in curriculum reforms.**
- 2. Assessment programs are developing more complex performance assessments.**
 - Changing psychological and educational theory**
 - For example, development of assessments based on models of the reading process and theory of teaching and learning mathematics**
 - Time lag between theory and assessment development and adaptation to educational practice**
- 3. Historical independence of assessment development from classroom practice.**

TABLE 3

**The Mathematics Assessment Questionnaire:
A Survey of thoughts and feelings**

**Statements ask learners to reflect on learning and doing
mathematical word problems to assess**

student characteristics

- 1. awareness of self-regulatory skills and beliefs**
- 2. affective, motivational, and attributional beliefs**

in the context of classroom activities

- 1. During class, when a teacher leads a lesson**
- 2. Working with others, in a problem solving group**
- 3. Doing homework, an independent activity**

TABLE 4

Sample Statements from the Mathematics Assessment Questionnaire Illustrating Constructs and Classroom Activity Settings

Self regulation: During class

When I can think of another way to solve a word problem, I volunteer to show the class.

Anxiety: Working with others

I dread the thought of trying to solve a math word problem with other students.

Internal learning goals: Homework

I like to do hard homework math word problems because I learn more math by working them.

TABLE 5

**Sample answers to the question:
How did answering these questions help you to
think about how you do math problems?**

- **It gave me more ways to work a problem.**
- **Answering these questions made me think about how I solved the problem and made me double check my answer.**
- **It helps me think about what to do whenever I have math problems and it also helps me recall whether I check my work or not.**
- **Answering these questions helps me think about things that I don't do on math problems.**
- **The questions didn't really help me think about how you do math problems. But it gets you thinking.**

Figure 1

STRUCTURE OF THE TEACHER PROGRAM:
FLOW CHART OF TMAQ

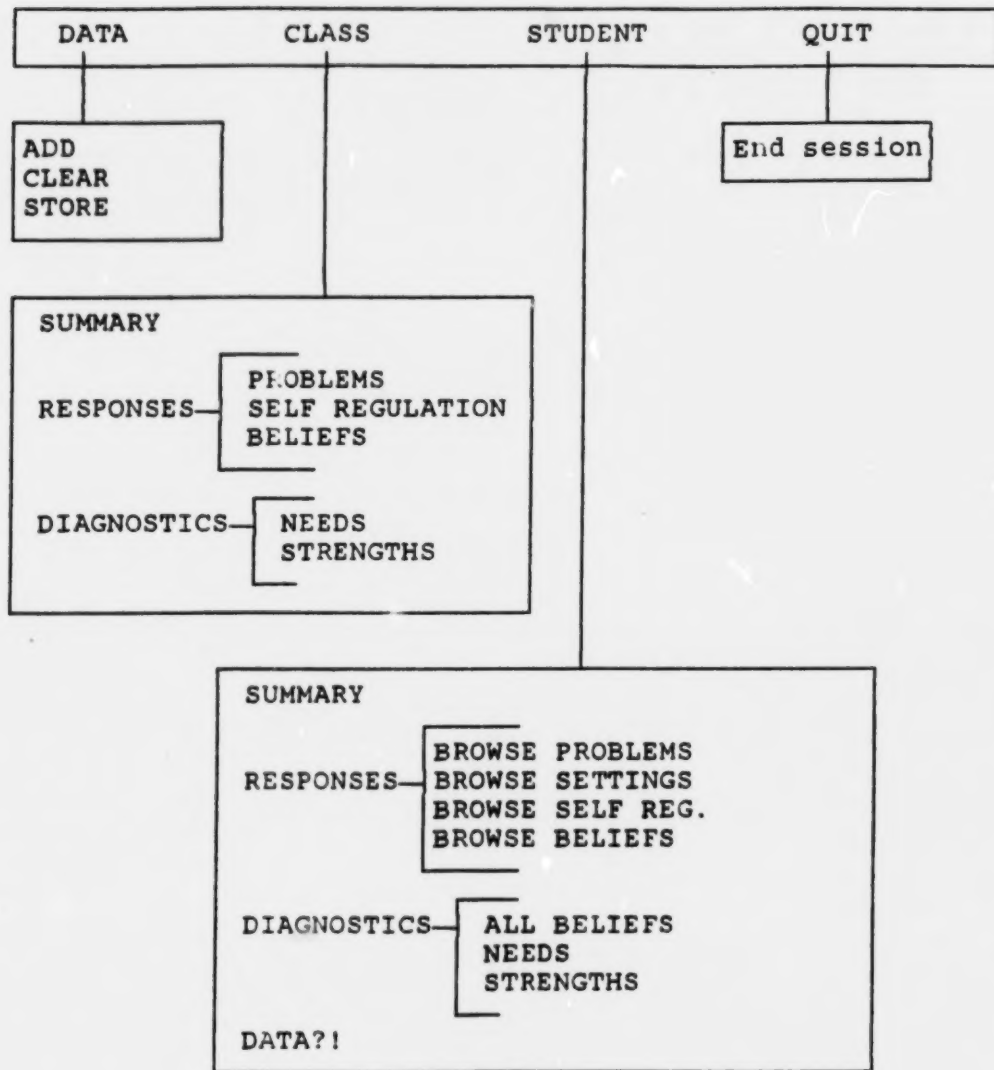


TABLE 6

Teacher Levels of Understanding of Student Responses

- 1. Acquiring procedural skills and conceptual structures**
 - i. acquiring facility with the computer program and the general structure of the assessment information**
 - ii. understanding the psychological constructs that comprise the assessment information (definitions)**
- 2. Contextualizing student responses in the psychological domain**
 - i. accessing other, relevant information about the student**
 - ii. interpreting the student or class response conditional upon this other information**
- 3. Using the contextualized information to select or develop specific instructional strategies**
- 4. Internalizing and transforming the assessment information about the psychological domain into other instructional settings and practices.**

TABLE 7

SAMPLE QUOTES FOR LEVELS 1, 2 AND 3

Level 1

Acquiring procedural skills and conceptual structures

"I like the summary of their responses. Where can I get that? I like to see the needs and strengths...I'm looking at the summary chart."

Level 2

Contextualizing the students' responses in the particular psychological domains

"...Julie ... I wouldn't suspect that she didn't like working with other students but now that I think of it she is one who likes to stay at her own desk in another part of the room ..."

Level 3

Using information from the MAQ to select or develop specific instructional strategies

"Confidence she probably doesn't like when I put her in a group which is why she's withdrawn and that would either make me want to pair her up with somebody that could help her with her anxiety about this or make sure that I give her individual attention..."

TABLE 8

Conditions necessary to support assessment development and research for teachers and learners in New York communities

- **Organizational arrangements that foster the integration of assessment R & D and educational practice**
 - **Communication, collaboration, collegueship**
- **Research and development studies that explicitly use theories of teaching and learning**
 - **Engineering, adaptation of theory and practice**
- **Development and adaptation of procedures to understand meaning and use of assessments; asking questions such as**
 - **What existing conceptions do teachers have about a learner's problem solving? How are these modified by particular assessments?**
 - **How do students construct meaning from holistic analyses of complex performance? How much do student's understand about an evaluation process?**